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United States
Department of
Agriculture

Forest Service

Forest
Products
Laboratory



Dividends From Wood Research

Recent Publications

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PROCUREMENT SECTION

adhesives

1. Relationship between Phenolic Adhesive Chemistry, Cure and Joint Performance. Part I. Effects of Base Resin Constitution and Hardener on Fracture Energy and Thermal Effects During Cure

Ebewele, R. O.; River, B. H.; Koutsky, J. A.
J. Adhes. 14:189-217; 1982

The authors explore the relationships between the composition of phenol resorcinol-formaldehyde resins and paraformaldehyde concentrations in the adhesive. Fracture behavior, if carefully controlled using fracture mechanics principles in specimen design, can be directly correlated with base resin reactivity and composition, time and temperature of cure, and filler type.

2. Bond Formation by Wood Surface Reactions. Part II. Chemical Mechanisms of Nitric Acid Activation

Rammon, R. M.; Kelley, S. S.; Young, R. A.; Gillespie, R. H.
J. Adhes. 14:257-282; 1982

Infrared and ultra-violet spectroscopic analysis of nitric acid treated sugar maple and isolated wood polymers indicates extensive oxidation, nitration, and hydrolysis of the wood polysaccharides and lignin, suggesting that these reactions are important aspects of nitric acid activation of wood surfaces.

3. Bond Formation by Wood Surface Reactions: Part III. Parameters Affecting the Bond Strength of Solid Wood Panels

Kelley, S. S.; Young, R. A.; Rammon, R. M.; Gillespie, R. H.
Forest Prod. J. 33(2):21-28; 1983

This study showed that samples of solid wood can be bonded by activating the wood surface. Sugar maple activated with 40 percent nitric acid provided the highest and most reproducible shear strengths.

4. Bond Formation by Wood Surface Reactions. Part IV. Analysis of Furfuryl Alcohol, Tannin and Maleic Acid Bridging Agents

Kelley, S. S.; Young, R. A.; Rammon, R. M.; Gillespie, R. H.
J. Wood Chem. Technol. 2(3):317-342; 1982

This study showed that high shear strengths of bonded wood panels could be achieved with bonds of either tannin or furfuryl alcohol in conjunction with nitric acid activation. Even stronger bonds were obtained with a tannin-furfuryl-alcohol-maleic acid formulation (T-F-M). A distinct advantage of the T-F-M system is minimal evolution of formaldehyde or other toxic chemicals from the bonded product.

5. Microscopy of Abrasive-Planed and Knife-Planed Surfaces in Wood-Adhesive Bonds

Murmanis, L.; River, B. H.; Stewart, H.
Wood Fiber Sci. 15(2):102-115; 1983

This report is a pictorial comparison by fluorescence light microscopy and scanning electron microscopy of the effect of abrasive planing, knife planing, and soaking and drying stresses on wood-adhesive bonds of yellow-poplar and Douglas-fir specimens.

6. Hydrolytic Stability of Cured Urea-Formaldehyde Resins

Myers, G. E.
Wood Sci. 15(2):127-138; 1982

The hydrolysis kinetics of several different urea-formaldehyde resins at different extents of cure and under different hydrolysis conditions are examined using an experimental method believed to be more reliable than that previously employed.

7. Use of Acid Scavengers to Improve Durability of Acid-Catalyzed Adhesive Wood Bonds

Myers, G. E.
Forest Prod. J. 33(4):49-57; 1983

The author investigates the addition of acid scavenging materials to acid-catalyzed adhesive systems to reduce the strength losses common with acid catalyzed degradation of wood polymer adjacent to the bondline. The study uses a phenol-formaldehyde adhesive, p-toluensulfonic acid catalyst, and yellow birch veneer as a model system. Results indicate that successful acid scavengers can be found for a particular system and application.

anatomy and properties

8. Strength of Untreated Douglas-Fir Foundation Piles After Some 70 Years Service

Schniewind, A. P.; Gammon, B.; Bendtsen, B. A.
Forest Prod. J. 32(11/12):39-46; 1982

The authors determined residual strength of Douglas-fir piles buried for about 70 years in fill and bay mud below the water table near the San Francisco waterfront. Results show losses in strength and stiffness in the

"Dividends From Wood Research" is a semiannual listing of recent publications resulting from wood utilization research at the Forest Products Laboratory. These publications are made available to the public to encourage private and commercial appli-

cation of Forest Service research. The Forest Products Laboratory is maintained in Madison, Wisconsin, by the Forest Service, U.S. Department of Agriculture, in cooperation with the University of Wisconsin.

punky zone ranging from 14 to 50 percent; however, full-diameter compression tests of pile sections show them to be essentially equivalent to new piles in load-carrying capacity.

buildings and construction

Charge Item

Evaluation, Maintenance, and Upgrading of Wood Structures, A Guide and Commentary.

Subcommittee on Evaluation, Maintenance, and Upgrading of Timber Structures of the Committee on Wood of the Structural Division of the American Society of Civil Engineers. Freas, A., exam. New York: ASCE; 1983.

Several FPL scientists contributed sections to this publication, which can be ordered from the publisher: American Society of Civil Engineers, 345 East 47th Street, New York, NY 10017. \$13.

Charge Item

Wall and Floor Systems: Design and Performance of Light-Frame Structures. In: FPRS Proceedings 7317, 1981 September 22-24; Denver. Madison, WI: Forest Products Research Society; 1983. 259 p.

Proceedings from a conference sponsored by FPL, USDA Forest Service, and Forest Products Research Society. FPL researchers are authors or co-authors of seven of the papers:

Gromala, D. S.; Polensek, A. Analysis and Design of Wall Systems Subjected to Axial and Bending Loads

Hans, G. E. Performance Goals for Thermal and Moisture Control in Light-Frame Wood Construction

Rudder, F.; Danner, W.; Jones, R. E. Noise Insulation Design for Light-Frame Construction

Schaffer, E. L.; White, R. H.; Brenden, J. Designing for Fire Safety

Sherwood, G. E.; TenWolde, A. Movement and Management of Moisture in Light-Frame Structures

Soltis, L. A.; Wolfe, R. W.; Tuomi, R. L. Design Approaches for Light-Frame Racking Walls

Zahn, John J. Strength Under Combined Loading.

The full proceedings can be ordered from the publisher: Forest Products Research Society, 2801 Marshall Court, Madison, WI 53705. \$17.60 member/\$22 nonmember.

9. Coordination of Performance Standards on Moisture Control in Buildings

Hans, G. E.

In: Lieff, M.; Trechsel, H. R., eds. Coordination of performance standards on moisture control in buildings, moisture migration in buildings, ASTM STP 779. Philadelphia, PA: American Society for Testing and Materials, 1982:141-147.

This paper reports on a proposed framework for coordination of building standards in the moisture migration and damage control area. The framework was developed by Task Group #6.21.04 of the ASTM Subcommittee on Serviceability of Building Materials.

10. Condensation Potential in High Thermal Performance—Cold Winter Climate

Sherwood, G. E.

USDA Forest Serv. Res. Pap. FPL 433, 1983

This paper presents the results of a study of moisture patterns in a variety of wall construction types exposed to weather conditions in a cold winter climate, i.e., Madison, Wis.

11. Moisture Movement and Control in Light-Frame Structures

Sherwood, G. E.; TenWolde, A.

Forest Prod. J. 32(10):69-73; 1982

The authors discuss the prevalent types of damage caused by moisture movement and condensation in light-frame structures and present control measures to prevent or correct moisture problems.

chemistry

12. Qualitative and Quantitative Analysis of Diterpene Resin Acids by Glass Capillary Gas-Liquid Chromatography

Foster, D. O.; Zinkel, D. F.

J. Chromatogr. 248:89-98; 1982

Open-tubular glass capillary columns are used to give the elution characteristics of 77 compounds (diterpene resin acid methyl ester mixtures) on six liquid stationary phases (Silar 10C, BDS, SP-2330, SP-1000, SE-54 and SE-30).

13. Distribution of Acetyl Groups in Southern Pine Reacted with Acetic Anhydride

Rowell, R. M.

Wood Sci. 15(2):172-182; 1982

Leach resistance, volume changes, chemical pick-up, and infrared spectroscopic analysis of southern pine modified with acetic anhydride show that chemical reaction takes place on the hydroxyl groups of cell wall polymers, and that stable acetate groups are formed. The modification does significantly improve resistance from decay and improve dimensional stability.

14. Wood-Polymer Composites: Cell Wall Grating With Alkylene Oxides and Lumen Treatments With Methyl Methacrylate

Rowell, R. M.; Moisuk, R.; Meyer, J. A.

Wood Sci. 15(2):90-96; 1982

Southern pine and maple are treated separately with propylene oxide (PO)-triethylamine, methyl methacrylate, and PO followed by methyl methacrylate. The effects of these treatments separately and in combination on mechanical properties are described.

15. Variation in Needle and Cortex Resin Acids During Shoot Development in *Pinus sylvestris*, *P. nigra*, and *P. strobus*

Tobolski, J. J.; Zinkel, D. F.

Forest Sci. 28(4):785-796; 1982

Diterpene resin acids of needle and cortex tissues from one *Pinus strobus* seed source, two *P. nigra* sources, and two *P. sylvestris* sources were identified and quantitatively determined by gas-liquid chromatography. Trends in resin acid composition in needles, associated primarily with shoot growth and maturation, were generally similar in all species, seed sources, and tissues, and often showed a pattern of increasing degree of oxidation during development.

degradation and protection

16. Carboxylic Acids Produced Through Oxidative Cleavage of Aromatic Rings During Degradation of Lignin in Spruce Wood by *Phanerochaete chrysosporium*

Chen, C-L.; Chang, H-m.; Kirk, T. K.

J. Wood Chem. Technol. 3(1):35-37; 1983

This paper is part of a series describing the chemical changes that occur in the lignin of spruce wood during its degradation by *Phanerochaete chrysosporium*. The 16 new degradation products reported here provide considerable insight into the chemistry of lignin biodegradation.

17. Mycelium Binding and Depolymerization of Synthetic ¹⁴C-Labeled Lignin During Decomposition by *Phanerochaete chrysosporium*

Chua, M.G.S.; Choi, S.; Kirk, T. K.

Holzforschung 37(2):51-61; 1983

The authors examine the relationship between depolymerization and CO₂ production from the aromatic carbons of lignin. The lignin undergoes a degradation-dependent binding to the fungal mycelium. The effects of L-histidine and L-glutamic acid on depolymerization and mycelial binding are also examined.

18. Wood Preservation: How Important Is The Wood Treating Industry

Gjovik, L. R.; Micklewright, J. T.
South. Lumberman 243(3018):34-36; 1982

This paper covers a small portion of the information developed by a government assessment team organized to evaluate the benefits that would result from the continued use of pesticides that contain pentachlorophenol (Penta), inorganic arsenicals, and coaltar. The team consisted of scientists from the USDA, EPA, and State Land Grant Universities and was organized in response to EPA's official notice of "Rebuttable Presumption Against Registration" (RPAR) for these pesticides.

19. Preservative Treatment Effects on Mechanical and Thickness Swelling Properties of Aspen Waferboard

Hall, H. J.; Gertjansen, R. O.; Schmidt, E. L.; Carll, C. G.; DeGroot, R. C.
Forest Prod. J. 32(11/12):19-26; 1982

This paper presents the first phase of a three phase ongoing study on preservative protection for waferboard used in a variety of end uses. The authors report the influence of preservative inclusion on the modulus of elasticity, modulus of rupture, internal bond, and irreversible thickness swelling properties of powdered and liquid phenolic resole resin-bonded aspen waferboard before and after accelerated aging.

20. Is Extracellular Hydrogen Peroxide Involved in Cellulose Degradation by Brown-Rot Fungi?

Highley, T. L.
Mater. und Org. 17(3):205-214; 1982

Of the six brown-rot fungi studied, only one produced significant quantities of extracellular H_2O_2 , casting doubt on its involvement in cellulose depolymerization by brown-rot fungi. However, $\bullet OH$ radicals are involved, and this involvement is discussed.

21. Migration of Creosote and Its Components from Treated Piling Sections in a Marine Environment

Ingram, L. L. Jr.; McGinnis, G. D.; Gjovik, L. R.; Robertson, G.
In: Proceedings, 78th annual meeting of the American Wood-Preservers' Association; 1982 May 2-5; New Orleans, LA.
Bethesda, MD: AWP; 1982: 120-128

Creosote oil is composed of 50-65 percent polycyclic aromatic hydrocarbons (PAH's), some of which are on the EPA's list of "priority pollutants." To provide baseline data on the rate of loss of both creosote oil and selected PAH's from treated wood in a marine environment, the authors investigate the migration of creosote and its components from marine pilings. Results indicate that the PAH's that migrate into the water should have only a negligible effect on the environment.

22. Effects of Polyoxin Inhibitors of Fungal Chitin Synthesis on the Decay of Wood

Johnson, B. R.
Int. Biodeterior. Bull. 18(2):37-42; 1982

This study aimed to determine to what extent the chitin-inhibiting effect of polyoxins could control fungal decay of wood. Though polyoxins are not themselves suitable wood preservatives, study results tentatively validate the concept of wood preservation via inhibition of fungal chitin synthesis.

23. A Look at Creosote vs. Chromated Copper Arsenate Salts as Wood Preservatives for the Marine Environment

Johnson, B. R.
Ind. Eng. Chem. Prod. Res. Dev. 21(4):704-705; 1982

This paper reports on findings of a study to determine which combination of preservative type, quality, and quantity would be the most effective and economical single or dual (combinations) treatment to protect wood in waters where teredine borers and *Limnoria tripunctata* are prevalent.

24. Chemical Modification of Wood for Improved Decay Resistance

Kalnins, M. A.
Wood Sci. 15(2):81-89; 1982

The author reports on the degree of decay resistance imparted to southern pine (and in some instances gum) by reaction with allyl isocyanate, methyl isocyanate, phenylhydrazine, and allyl isothiocyanate. The protection afforded is compared with that resulting from acetylation of wood.

25. Chemical Mechanism of an Important Cleavage Reaction in the Fungal Degradation of Lignin

Kirk, T. K.; Nakatsubo, F.
Biochim. Biophys. Acta 756:376-384; 1983

The $C_\alpha C_\beta$ cleavage is a major reaction of lignin degradation. The authors identify the primary C_α -derived product, and through the use of a series of β -1 substrates, further describe the cleavage mechanism.

26. Further Study Discounts Role for Singlet Oxygen in Fungal Degradation of Lignin Model Compounds

Kirk, T. K.; Nakatsubo, F.; Reid, I. D.
Biochem. Biophys. Res. Commun. 111(1):200-204; 1983

This study reexamines the authors' contention that singlet oxygen plays a role in the fungal degradation of lignin. Findings showed that singlet oxygen is not responsible for cleavage of 1,2-bis (4-methoxyphenyl) propane-1,3-diol or related compounds in the fungal cultures or in the photochemical system.

27. Detecting Incipient Brown Rot With Fluorescence Microscopy

Krahmer, R. L.; DeGroot, R. C.; Lowell, E. C.
Wood Sci. 15(2):78-80; 1982

The authors observe a change in fluorescence color in southern yellow pine sapwood with varying levels of incipient decay. Nondecayed wood stained with acridine orange fluoresces green; wood with 1 to 3 percent weight loss fluoresces greenish orange; and wood with greater than 3 percent weight loss fluoresces orange.

28. Regulation of Ligninolytic Activity by Nutrient Nitrogen in White-Rot Basidiomycetes

Leatham, G. F.; Kirk, T. K.
FEMS Microbiol. Lett. 16:65-67; 1983

Findings from this study indicate that regulation of ligninolytic activity by nutrient nitrogen limitation is not a universal phenomenon among white-rot basidiomycetes, and that for non-nitrogen-regulating species, it may be possible to add nitrogen to increase mushroom yields without interfering with lignin degradation.

29. Incorporation of $^{18}O_2$ and Absence of Stereospecificity in Primary Product Formation During Fungal Metabolism of a Lignin Model Compound

Nakatsubo, F.; Reid, I. D.; Kirk, T. K.
Biochim. Biophys. Acta. 719:284-291; 1982

To help elucidate the biochemical mechanism of lignin degradation, the authors study the metabolism of 1,2-bis(3-methoxy-4-ethoxyphenyl) propane-1,3-diol (Ia) in ligninolytic cultures of *Phanerochaete chrysosporium*. Experiment results provide the first evidence of the involvement of molecular oxygen directly in the cleavage of intermonomeric linkages, and the first evidence for absence of stereospecificity in primary product formation during lignin metabolism.

30. Decay Patterns Observed in Butylene Oxide Modified Ponderosa Pine Attacked by *Fomitopsis Pinicola*

Nilsson, T.; Rowell, R. M.
The International Research Group on Wood Preservation, Working Group 1, Biological Problems. Document No.: IRG/WP/1183. Stockholm, Sweden; 1983, 6 p.

Ponderosa pine blocks modified by butylene oxide were decayed for 2 months with the brown-rot fungus *Fomitopsis pinicola*. Wood blocks treated to 23.7 weight percent gain showed cracks in both the middle lamella regions of radial walls and in cell corners of latewood tracheids. The fungus entered the cracks and progressed along the middle lamella and towards the cell lumen.

31. Wood Preservation and Stabilization by Chemical Modification of the Wood Substance

Rowell, R. M.

In: Chemical aspects of wood technology. STFI series A no. 772. Stockholm: Swedish Forest Products Research Laboratory; 1982:32-49.

The author treated wood with simple epoxides and isocyanates which react with wood cell wall polymer hydroxyl groups. The bonded chemicals caused 50 to 70 percent dimensional stability at chemical weight gains of 20 to 30 percent. Above this level, the cell wall structure broke down and dimensional stability was lost. Good resistance to biological attack was observed in wood modified to levels of 20 to 30 percent weight gains.

32. Twenty-Year Test of On-Site Preservative Treatments to Control Decay in Exterior Wood of Buildings

Scheffer, T. C.; Eslyn, W. E.

Mater. Org. 17(3):181-198; 1982

In southern Mississippi, several kinds of millwork joints of Douglas-fir heartwood and southern pine sapwood were treated with pentachlorophenol, either in carrying oils applied by brushing or spraying or as a grease-like matrix, and exposed outdoors for 18 to 20 years. Results suggest that for good protection of joints of light dimension wood, where checking of surface is minimal, a suitable quality of treating liquid and appropriate concentration of the preservative are more essential than deep penetration.

33. Degradation and Conversion of Lignocelluloses

Kirk, T. K.

In: The filamentous fungi. vol. 4. Fungal technology. London: Edward Arnold; 1983: 266-295.

The degradation of lignocelluloses is one of the most important biodegradative events in the earth's carbon cycle. This overview covers the chemistry and structure of lignocelluloses, microbes that metabolize lignocelluloses, growth of fungal hyphae in wood and microscopy of degradation, chemistry and biochemistry of biodegradation, deterioration of lignocelluloses, and lignocellulose conversion.

34. Molecular Basis for the Biodegradative Recalcitrance of Lignin in Anaerobic Environments

Zeikus, J. G.; Wellstein, A. L.; Kirk, T. K.

FEMS Microbiol. Lett. 15:193-197; 1982

This is the first documentation that a lignin-related dimer containing the β -aryl ether bond, kraft industrial lignin, and low molecular weight aromatic degradation products of synthetic lignin are decomposed by anaerobic microbial processes.

design data

35. Plane Stress Analysis of Wood Members Using Isoparametric Finite Elements—A Computer Program

Gerhardt, T. D.

USDA Forest Serv. Gen. Tech. Rep. FPL-35; 1983

A finite element program is presented which computes displacements, strains, and stresses in wood members of arbitrary shape which are subjected to plane strain/stress-loading conditions. This report extends a program developed by R. L. Taylor in 1977, by adding both the cubic isoparametric finite element and the capability to analyze nonisotropic materials.

36. Orthotropic Beams Under Normal and Shear Loading

Gerhardt, T. D.; Liu, J. Y.

J. Eng. Mech. 109(2):394-410; 1983

A plane stress elasticity solution is presented for the problem of an orthotropic beam under arbitrary normal and shear loading along the lateral beam surfaces. Beam equations for use in design applications are developed for the calculation of bending and shear stresses for orthotropic or isotropic beams under normal and shear loading conditions. The elasticity solution is used to examine the validity of these equations.

37. An Investigation of the Fracture of Butt Joints in Parallel-Laminated Veneer

Jung, J.; Murphy, J. F.

Wood Fiber Sci. 15(2):116-134; 1983

The authors conduct a finite-element analysis and experimental testing program to investigate the fracture mechanics aspects of butt joints in parallel-laminated veneer. Results show that Mode I fracture toughness of exterior butt-jointed specimens varies with veneer thickness and number of plies. Butt-joint interaction tests indicate a much higher degree of joint interaction than predicted by finite-element analysis.

38. Characterizing the Nonlinear Behavior of Flakeboards

Laufenberg, T. L.

Wood Fiber Sci. 15(1):47-58; 1983

This paper describes a method for characterizing the nonlinear behavior of a flakeboard subjected to axial stresses. The model helps predict the stress-strain curve to the ultimate stress and ultimate strain points for the material regardless of fiber alignment or board density.

39. A Weibull Analysis of Wood Member Bending Strength

Liu, J. Y.

J. Mech. Design 104:572-576; 1982

The analysis of size effect on bending strength of rectangular wood beams based on Weibull's theory of brittle failure has been expanded here to include tapered wood beams under arbitrary loading conditions. Numerical data for Douglas-fir beams are presented in graph form, where necessary, for easy application by the design engineer.

40. Criterion for Mixed Mode Fracture in Wood

Mall, S.; Murphy, J. F.; Shottafer, J. E.

J. Eng. Mech. 109(3):680-690; 1983

The authors investigate the mixed mode fracture of wood to develop a mixed mode fracture criterion based on experimental results. Results demonstrate a definite interaction between failure stress intensity factors K_I and K_{II} during the mixed mode fracture of wood. These mixed mode data are supplemented by the fracture toughness (K_{IC}) and pure mode II critical stress intensity factor (K_{IIc}). Several mixed mode fracture failure criteria are compared. The criterion that could not be rejected is: $K_I/K_{IC} + (K_{II}^2/K_{IIc}^2) = 1$.

41. Deflections and Stresses in Circular Tapered Beams and Poles

McCutcheon, W. J.

Civil Eng. Pract. Des. Eng. 2:207-233; 1983

Equations are derived for calculating the deflections and stresses in circular tapered beams and poles. A set of graphs provides a rapid means for determining the locations and magnitudes of maximum deflections and stresses.

42. Lateral Stability of Beams with Initial Imperfections

Zahn, J. J.

J. Eng. Mech. 109(3):821-835; 1983

This paper presents a variational derivation of a set of linear differential equations and boundary conditions. They are used to calculate the forces in midspan diagonal bracing members on a simply supported wooden beam under constant bending (such as found in large flat-roof building systems). A sample calculation for a typical wood roof application shows the forces in the bracing to be quite small.

fire

43. Efficient Application of Boron Fire Retardant to Cellulosic Loose-Fill Insulation

Wegner, T. H.; Holmes C. A.

In: Proceedings, Thermal insulation, materials, and systems for energy conservation in the 80s. ASTM STP 759. Philadelphia, PA: ASTM; 1983: 100-113

Different methods of applying boron fire-retardant chemicals are investigated for their effectiveness in improving fire performance of cellulose insulation. The aqueous method performs better than dry powder or vapor application, meeting the fire performance standards for

smoldering and flame spread (for larger particle size newsprint-derived insulation) with a fire retardant loading substantially below the 25 percent required with dry powder application.

general

44. Aids for Economic Analysis of Wood and Bark Use of Fuel

Harpole, G. B.

In: Proceedings, 25th annual Rocky Mountain forest industries conference; 1981 May 13-15; Rapid City, SD. Pierre, SD: South Dakota Division of Forestry; 1982: 93-97.

This paper describes four different aids that have been developed and used at the Forest Products Laboratory for economic analysis of wood and bark residues used as fuel.

45. Economic Perspective on Harvesting and Physical Constraints on Utilizing Small, Dead Lodgepole Pine

Ince, P. J.

Forest Prod. J. 32(11/12):61-66; 1982

The author concludes from his study that small, dead timber can be used for a variety of products, and he discusses those that are most profitable. He suggests that forest products research continue developing higher value products for small, dead timber, as "there is no greater motivating factor for harvesting this resource than profits induced by increasing its value."

46. A Materials Science Approach to Wood Science

Marra, G. G.

In: Proceedings, 9th International symposium on forest science; 1981 August 31 to September 6; Seoul, Korea. Washington, DC: National Academy of Sciences; 1982: 57-86.

A materials science approach to wood relates composition, structure, and processing variables to properties. The goal is to achieve a desired property of a material through knowledgeable combination of ingredients and control of processing variables. This paper describes how wood fits into the concepts of conventional materials science and how this approach can lead to a more important role for wood in the future.

47. Strategies for Corporate Timberland Ownership and Management

O'Laughlin, J.; Ellefson, P. V.

J. For. 80(12):784-788; 1982

This article lists the largest owners of industrial forestlands. It indicates why their timberlands are important to them, and it describes corporate strategies for timberland ownership and management. Strategies of wood-based subsidiaries of large diversified companies with similarly sized companies dependent on wood for their basic business are compared.

mycology

48. Species of Effused Aphyllophorales (Basidiomycotina) from the Southeastern United States

Burdsall, H. H. Jr.; Nakasone, K. K.

Mycotaxon 17:253-268; April-June 1983

Six new species of Corticiaceae are proposed, described, and illustrated. They are *Dendrothele bispora*, *Dendrothele subfusispora*, *Hyphoderma leoninum*, *Hyphoderma rimosum*, *Hypochnicium stratosum*, and *Peniophora sphaerocystidiata*. *Tubulicium capitatum*, a new combination, and *Steccherium seriatum* are also described and illustrated. Cultural characters are provided for four species.

49. Cultural and Morphological Studies on *Cystostereum Australe* (Corticiaceae), A New Species from Southeastern U.S.A. and Costa Rica

Nakasone, K. K.

Mycotaxon 17:269-274; 1983

Cystostereum australe, a new species from southeastern U.S.A. and Costa Rica, is reported. The basidiocarp and cultural characteristics of the new species are described, illustrated, and compared with *Cystostereum murraili*, a common and widely distributed wood decay fungus to which the new species is closely related.

packaging

50. Corrugated Fibreboard with High Oak Content Linerboard Can Be Scored

Bormett, D. W.

Boxboard Containers 90(8):27-30; 1983

Fracturing of scorelines on corrugated fibreboard is evaluated as a function of: 1) moisture content during scoring, 2) linerboard oak content, 3) score-flute orientation, and 4) scorewheel clearance. No fracturing occurs for scores perpendicular to the flutes. Parallel scoreline fracturing can be eliminated for any oak content in the linerboard given a sufficient scorewheel clearance and moisture content during scoring and folding.

processing

—drying

—sawing

—grading

51. Effect of High-Temperature Drying on Bending Strength of Yellow-Poplar 2 by 4's

Gerhards, C. C.

Forest Prod. J. 33(2):61-66; 1983

Based on bending strength tests of 809 processed 8-foot-long 2 by 4's, an analysis of covariance shows that strength of high-temperature-processed lumber is only negligibly lower than and not significantly different from that for lumber processed by conventional sawing and drying. Also, strength is highly correlated with modulus of elasticity, and 2 by 4's containing tree pith were not as strong or stiff as those without pith.

52. Economics of Manufacturing Structural Lumber from Low- to Medium-Density Hardwoods

Harpole, G. B.

USDA Forest Serv. Res. Pap. FPL 432; 1983

This paper presents an economic assessment and comparison of two hypothetical sawmills that use recent FPL technology. One mill uses SDR, a process for manufacturing quality structural lumber from hardwoods, and the other uses SDR combined with EGAR, which enables the manufacture of any width of structural lumber from small logs. Both systems show themselves viable investment opportunities.

53. Payback as an Investment Criterion for Sawmill Improvement Projects

Harpole, G. B.

USDA Forest Serv. Gen. Tech. Rep. FPL-34, 1983

The author describes and illustrates how payback ratios are calculated, how they can be used to rank alternative improvement projects, and how to calculate the benefit value of improvement projects.

54. What Have We Learned From the Sawmill Improvement Program After Nine Years?

Lunstrum, S.

South. Lumberman 243(3028):42-44; 1982

The Sawmill Improvement Program, better known as SIP, was launched by the U.S. Forest Service in July of 1973 to help extend the Nation's timber resource through more efficient sawmilling of logs. Since the program was initiated, log requirements to produce a given amount of lumber have been reduced by 15 percent. This article explains how SIP has helped achieve this improvement.

55. Manufacture of Quality Yellow-Poplar Studs Using the Saw-Dry-Rip (SDR) Concept

Maeglin, R. R.; Boone, R. S.

Forest Prod. J. 33(3):10-18; 1983

This paper describes Saw-Dry-Rip (SDR), a new and economically viable system for manufacturing studs from low- and medium-density hardwoods that produces high-quality STUD grade material from yellow-poplar. In a comparison of four sawing and drying treatments by evaluating warp, SDR yielded 100 percent of the studs acceptable and showed an 80 percent reduction in average crook compared to conventionally sawed and dried treatment.

56. Predrying Before Press-Drying to Reduce Drying Defects in Hardwoods

Simpson, W. T.
Forest Prod. J. 32(11/12):77-80; 1982

A new hardwood drying approach is suggested in this paper where low-temperature predrying of entire boards is followed by manufacture into clear cuttings. These cuttings are then press dried to the desired final moisture content. This technique overcomes the defect problems common to press-drying hardwood lumber from the green condition.

pulp and paper

57. Mechanisms Affecting Fiber Bonding During Drying and Aging of Pulp

Klungness, J. H.; Caulfield, D. F.
Tappi J. 65(12):94-97; 1982

The authors study fundamental fiber changes of hand sheets made from dried and aged pulps. Initial property losses on drying result from irreversible bonding of cellulose surfaces and losses upon aging from hydrolytic cleavage and internal fiber bonding. Drying reduces both specific surface areas and specific volume. The authors suggest that future research aim at overcoming effects of internal fiber bonds through combined mechanical and mild chemical treatment.

58. Characteristics of Combined Effluent Treatment Sludges From Several Types of Pulp and Paper Mills

McGovern, J. N.; Berbee, J. G.; Bockheim, J. G.; Baker, A. J.
Tappi J. 66(3):115-118; 1983

Sludges from primary-secondary effluent treatment systems serving 10 highly diversified pulp and paper mills on the Wisconsin River are analyzed for total solids, carbohydrates, ash, and elemental composition. Sludge characteristics vary several-fold according to mill processes and effluent treatment. Use of the sludges for land spreading and incineration is discussed with respect to these characteristics.

59. Kinetics of Alkaline Cleavage of β -Aryl Ether Bonds in Lignin Models: Significance to Delignification

Obst, J. R.
Holzforschung 37(1):23-28; 1983

Results from studying the kinetics of the alkaline cleavage of β -O-4 aryl ethers of nonphenolic units for lignin models veratrylglycol- β -guaiacyl ether (I) and veratrylglycerol- β -guaiacyl ether (II) do not support the supposition that the kraft delignification rate of wood may be described by the kinetics of simple lignin models, but rather on the basis of lignin depolymerization.

60. Adducts of Anthrahydroquinone and Anthranol with Lignin Model Quinone Methides. 2. Dehydration Derivatives. Proof of Threo Configuration

Ralph, J.; Landucci, L. L.
J. Org. Chem. 48:372-376; 1983

Knowing how the chemical mechanisms of catalysts operate in pulping systems allows the manipulation of such mechanisms for greater efficiencies and lower costs. This study describes the proof of a specific stereo-chemical form (threo) of what is thought to be a key intermediate in AQ catalyzed delignification.

61. Evaluation of Chemical Treatments for Maintaining Brightness of Stored Wood Chips

Springer, E. L.
Tappi J. 66(2):93-96; 1983

Four chemical treatments are evaluated for their effectiveness in maintaining the brightness of western hemlock and Douglas-fir chips. Formaldehyde treatment maintained the brightness of both wood species near the original level during storage. Sodium bisulfite treatment increased the original brightness and maintained it above the original level for 12 weeks.

62. Prehydrolysis of Aspen Wood with Water and with Dilute Aqueous Sulfuric Acid

Springer, E. L.; Harris, J. F.
Svensk Papperstidn. 85(15): R152-R154; 1982

This study shows that at a reaction temperature of 170° C, water prehydrolysis of aspen wood gives much lower yields of total anhydroxylose units in the prehydrolyzate and removes more glucan from the wood than does prehydrolysis with dilute solutions of sulfuric acid. Reaction temperatures above 170° C could be expected to cause the yields of total anhydroxylose units in the water prehydrolyzate to begin to approach those in the acid prehydrolyzate.

63. Role of Fiber Geometry in Water Removal by Wet Pressing

Wegner, T. H.; Young, T. L.; Caulfield, D. F.
Tappi J. 66(4):85-88; 1983

The effect of fiber geometry on two parameters of web dewatering and apparent compressive modulus is examined using handsheets of loblolly pine, spruce, and southern red oak. In addition, the effects of wet moisture content entering the wet press and furnish freeness on the parameters are determined.

residues and energy

64. New Findings on Wood Fuel Values

Baker, A. J.
Am. Forests (2):45-47, 51-52; 1983

Based on FPL research, the author offers homeowners more data on burning characteristics of different types of wood, along with advice on the most efficient burning methods.

65. A Comparison of *Candida tropicalis* and *Pachysolen tannophilus* for Conversion of Xylose to Ethanol

Jeffries, T. W.
In: Gaden, E. L., Jr., ed., Biotechnology and bioengineering symposium no. 12. New York: John Wiley and Sons, Inc.; 1982: 103-110.

The author compares two yeasts, *P. tannophilus* and *C. tropicalis*, under aerobic and anaerobic conditions to determine some of the principal relationships between aeration and ethanol production of these organisms. Results show that aeration is essential for ethanol production by *C. tropicalis*, but *P. tannophilus* will carry out conversion of D-xylose under anaerobic conditions.

66. Future of Wood as a Boiler Fuel

Zerbe, J. I.
In: Proceedings, Technical Association of the Pulp and Paper Industry 1982 engineering conference, book 2; 1982 September 13-16; San Francisco, CA. Atlanta, GA: TAPPI Press; 1982: 393-398

The Energy Security Act of 1980 requires an Implementation Plan for use of biomass fuels from 1983 to 1990. Projections on the use of wood as a boiler fuel have been developed for this plan and are presented in this paper along with wood biomass availability information and cost estimates.

67. Wood Production of Liquid or Gaseous Fuels

Zerbe, J. I.
In: United Nations Economic Commission for Europe. Papers presented to the seminar on energy conservation and self-sufficiency in the sawmilling industry; 1982 September 13-17; Bonn, Federal Republic of Germany. Bonn; 1982: 333-344

Since the rapid rise of fossil fuel costs during the last decade, fuels derived from biomass, which have been only marginally competitive, may become more desirable. The author discusses the past, present, and future of liquid or gaseous fuels produced from wood.

68. Technologies for Energy Production from Sawmilling Residues

Zerbe, J. I.
In: United Nations Economic Commission for Europe. Papers presented to the seminar on energy conservation and self-sufficiency in the sawmilling industry; 1982 September 13-17; Bonn, Federal Republic of Germany. Bonn: 1982: 364-370

The author discusses present and future technologies for turning sawmilling residues into energy. Highlighted are suspension burning, fluid-bed burning, generation and cogeneration of electricity, gasification, and pyrolysis.

wood materials

69. Wood Particleboard Types, Grades, and Uses

Carll, C.

USDA Forest Serv. Forest Prod. Lab. Unnumbered Rep., 1981 (previously published report available in limited quantities)

The author presents an overview of particleboard—what is it, how is it used, and what standards are available for its manufacture.

70. U.S. Wood-Based Panel Industry:

Part I. Production Trends and Changing Markets;

Part II. Standards for Panel Products;

Part III. Research and Technological Innovations;

Part IV. Energy, Environmental Protection, and Occupational Safety and Health

Carll, C. G.; Dickerhoof, H. E.; Youngquist, J. A.

Part I: Forest Prod. J. 32(6):14-23; 1982

Part II: Forest Prod. J. 32(7):12-15; 1982

Part III: Forest Prod. J. 32(8):14-24; 1982

Part IV: Forest Prod. J. 32(9):14-22; 1982

Part I deals with production, consumption, and marketing of several product categories. Major commodity uses are reviewed and product imports and exports are highlighted. Part II reviews the standards for wood-based panel production and use, describing the types of standards and standards-writing organizations in the United States. Part III reviews research developments in the field of composite products that are impacting the U.S. wood-based panel products industry, or may impact the industry. Part IV addresses three large considerations for panel products facilities: energy use, environment protection, and employee health and safety.

71. Steam Injection Pressing

Geimer, R. L.

In: Proceedings, 16th International particleboard symposium; 1982 March 30-April 1; Pullman, WA. Pullman, WA: Washington State University; 1983: 115-134.

The author describes a new FPL development for injecting saturated steam into a 1/2 in., 40 lb/ft³ phenolic-bonded flakeboard mat during press closure to reduce by 60 percent the time needed to bring the centerline of the flakeboard to resin curing temperatures.

72. Laboratory Performance of a Powered Back-up Roll for Peeling Veneer

Loehnertz, S. P.

USDA Forest Serv. Res. Pap. 429; 1982

The author evaluates the performance of a prototype powered back-up roll (PBR), an FPL technology for alleviating spin-out in veneer production by providing adequate torque. The PBR can provide up to 100 percent of the torque required for peeling 4-foot bolts.

73. Industrial Performance of Powered Back-up Roll for Peeling Veneer

Loehnertz, S. P.

USDA Forest Serv. Res. Pap. FPL 430; 1982

A commercial model of FPL's powered backup roll for alleviating veneer log spin-out was installed in Boise Cascade's Yakima plywood plant. The system is described and the results from a test program evaluating the operation of the equipment are given.

74. Properties of Hardboards Made From Tropical Hardwoods and Aspen Chips Before and After Simulated Outdoor Storage

Myers, G. C.

Forest Prod. J. 33(2):39-42; 1983

This study shows the feasibility of long term storage of Philippine hardwood chips for dry-formed hardboard manufacture. High-density hardboards made from the aged chips had greater bending strength, internal bond, and thickness swelling than did boards made with fresh chips.

75. Thickness Loss in Hot-Pressed Plywood

Wellons, J. D.; Krahmer, R. L.; Sandoe, M. D.; Jokerst, R. W.

Forest Prod. J. 33(1):27-34; 1983

This study of 5/8-inch plywood made from conventionally dried and platen-dried veneer examines the effect of veneer moisture content, press temperature, press pressure, and wetting of hot panels on percent thickness loss. Losses are minimized by reducing pressure at press closure or during the press cycle. Panels wetted right after hot-pressing recovered 1 percent thickness.

76. Powered Backup Roll—A Way to Improve Hardwood Veneer Yields

Youngquist, J. A.

In: Proceedings, 10th annual hardwood symposium; 1982 May 12-15; Cashier, NC. Asheville, NC: Hardwood Research Council; 1983: 66-80

FPL developed the powered backup roll to increase efficiency in veneer peeling. The author discusses the opportunities the PBR can provide to reduce spinout losses, peel thicker veneer, peel previously unpeelable material, and peel to thinner cores.

cooperative research

Listed below are recent publications from universities or others involved in cooperative research with the Forest Products Laboratory. Copies are not available from the Laboratory but may be obtained from the contacts listed following each publication.

The Effect of Species and Moisture Content on the Bonding Efficiency of Polymeric MDI Isocyanate

Johns, William E.; Maloney, Thomas M.; Saunders, John B.; Huffaker, E. Max; Lenz, Martin T.
In: Proceedings, 16th International symposium on particleboard; 1982 March 30-April 1; Pullman, WA. Washington State University, Wood Technology Section, Pullman, WA 99164, U.S.A.

¹³C NMR Study of Cured Furfuryl Alcohol Resins Using Cross Polarization and Magic-Angle Spinning

Maciel, Gary E.; Chuang, I-Ssuer; Myers, George E.
Macromol. 15(4):1218-1220; 1982. Reprints available from Professor Gary E. Maciel, Department of Chemistry, Colorado State University, Fort Collins, CO 80523, U.S.A.

¹³C NMR Studies of Solid Urea-Formaldehyde Resins Using Cross Polarization and Magic-Angle Spinning

Maciel, Gary E.; Szeverenyi, Nikolaus M.; Early, Thomas A.; Myers, George E.
Macromol. 16(4):598-603; 1983. Reprints available from Professor Gary E. Maciel, Department of Chemistry, Colorado State University, Fort Collins, CO 80523, U.S.A.

Econometric Model of Price Formation in the United States Paper and Paperboard Industry

Buongiorno, Joseph; Farmimani, Merhdad; Chaung, Wu-Jen
Wood Fiber Sci. 15(1):28-39; 1983. Reprints available from Society of Wood Science and Technology, P.O. Box 5062, Madison, WI 53705.

The Dynamics of Residential Wood-Energy Use in the United States: 1970-2030

Marshall, Norman L.; Patten, Bryant M., II; Skog, Kenneth
Reprints available from Thayer School of Engineering, Dartmouth College, Hanover, NH 03755, U.S.A.

Wood Floor with Nonlinear Nail Stiffness

Wheat, Dan L.; Vanderbilt, M. Daniel; Goodman, James R.
J. ASCE Struc. Eng. 109(5):1290-1303; 1983. Reprints can be ordered by using the coupon published in Civil Engineering magazine and ASCE Publications Information.

Handbook of Physical and Mechanical Testing of Paper and Paperboard

Mark, Richard E., ed.; Murakami, Kaji, assoc. ed.
Marcel Dekker, Inc., 270 Madison Ave., New York, NY 10016.

Isocyanate Bonded Aspen Flakeboard

Johns, William E.
Forest Prod. J. 32(11/12):47-50; 1982. Reprints available from Forest Products Research Society, 2801 Marshall Court, Madison, WI 53705, U.S.A. (\$2 plus 10% postage and handling. Minimum \$5 order).

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